Coastal Resiliency

This guidance is intended to clarify how the Coastal Resiliency Goal and Objectives of the Regional Policy Plan (RPP) are to be applied and interpreted in Cape Cod Commission Development of Regional Impact (DRI) project review. This technical bulletin presents specific methods by which a project can meet the goal and objectives.

Coastal Resiliency Goal: To prevent or minimize human suffering and loss of life and property or environmental damage resulting from storms, flooding, erosion, and relative sea level rise, including but not limited to that associated with climate change.

- ***Objective CR1*** *– Minimize development and risk within areas vulnerable to flooding*
- ***Objective CR2*** *– Plan for erosion*
- ***Objective CR3*** *– Restore coastal resource areas to promote their natural beneficial functions*

The applicability and materiality of these goals and objectives to a project will be determined on a case-by-case basis considering a number of factors including the location, context (as defined by the Placetype of the project's location), scale, use, and other characteristics of a project.

THE ROLE OF CAPE COD PLACETYPES

The RPP incorporates a framework for regional land use policies and regulations based on local form and context as identified through categories of Placetypes found and desired on Cape Cod.

The Placetypes are determined in two ways: some are depicted on a map contained within the RPP Data Viewer located at www.capecodcommission.org/RPPDataViewer adopted by the Commission as part of the Technical Guidance for review of DRIs, which may be amended from time to time as land use patterns and regional land use priorities change, and the remainder are determined using the character descriptions set forth in Section 8 of the RPP.

The project context, as defined by the Placetype of the project's location, provides the lens through which the Commission will review the project under the RPP.

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INTRODUCTION

Over the last several decades Cape Cod has seen considerable growth and development, much of it in the coastal zone. With 586 miles of coastline, one of the most significant risks to the region is the destructive impacts of increasingly intense coastal storms, extreme precipitation, and associated flooding, with both flooding and erosion exacerbated by rising sea levels. This means that some of the most scenic and desirable development sites are located in areas that are vulnerable to some kind of coastal hazard: storm surge, erosion, flooding, and sea-level rise.

Development within the floodplain places thousands of properties at risk. The Cape Cod Commission's Climate Action Plan estimated that adapting the coast to sea level rise and storm surge could avoid a potential $50 billion in losses resulting from damaged roads, residential real estate and economic assets, lost tax revenue, reduced beach tourism, and decreased land value through 2100. Cape Cod's coastlines are active with nonwater dependent development. Since the vast majority of the coastline is privately owned, decisions about how to prepare for and respond to coastal threats have fallen on the property owner. The Regional Policy Plan encourages a shift to more coordinated preparation and planning for coastal threats, and toward reducing hazards within the coastal zone.

Flood hazard areas are those areas defined and delineated by the Federal Emergency Management Agency (FEMA) as V and A Zones – areas impacted by storm driven wave action and/or inundated by flood waters. The V and A Zones are delineated by FEMA on Flood Insurance Rate Maps (FIRMs, also known as FEMA Flood Maps), and adopted by communities who participate in the National Flood Insurance Program (NFIP).

FEMA Flood Maps are developed based on past flood conditions. These maps do not consider expected changes that will occur with sea level rise and increasingly intense storm events. As sea level continues to rise and storm intensity increases, the FEMA Flood Maps no longer reflect the full extent of flood risk. There is a need to manage development activity within flood hazard areas today and into the future to reduce the impacts of storm-related damage to both the natural and built environment. Flood models, such as the Massachusetts Coast Flood Risk Model (MC-FRM), provide a more precise representation of future flood risk. Both FEMA Flood Maps and the best available coastal flooding model are used to evaluate DRIs.

Every effort should be made to avoid new development within the Present (FEMA) and Future Floodplain. Development within the floodplain is vulnerable to coastal storms, and increasingly will be vulnerable to the effects of sea level rise. Damage from coastal threats impacts property owners, neighbors, emergency responders, and the ability of the environment to provide important ecosystem services upon which the community relies.

Structures in the floodplain can redirect or channelize flooding and increase flood velocity, exacerbating flood damage, erosion and damage to wetlands resources, buildings, roads and other structures. Debris, building materials and hazardous materials washed into the flooded area damage and pollute sensitive wetland resources.

For all development within the floodplain, applicants are encouraged to develop storm-preparedness and response plans to be prepared for coastal storms and floods and for post-disaster response to ensure the development is safe during storm events and any debris from the development is handled expeditiously and appropriately in coordination with local authorities.

DEFINITIONS

Areas Vulnerable to Flooding: Any land which is subject to inundation caused by coastal storms and sea level rise, including V and A Zones as defined by FEMA, and that predicted to be caused by the 1% annual storm for 2070, as defined by the Massachusetts Coast Flood Risk Model. A Zones include the Coastal A (MoWA) and A Zone (MiWA) identified in the draft DEP Floodplain regulations, excluding A zones without elevations determined.

Base Flood Elevation: The elevation to which floodwater is anticipated to rise during the base flood. Base flood elevations (BFEs) are shown on Flood Insurance Rate Maps (FIRMs). The BFE is the regulatory requirement for the elevation or floodproofing of structures.

Coastal Bank: The seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland, as defined in the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.30).

Design Flood Elevation: The elevation of surface water resulting from inundation caused by sea level rise and coastal storms up to and including that predicted to be caused by the 1% annual storm in 2070, as defined by the Massachusetts Coast Flood Risk Model, or the State Building Code, whichever is higher. Reference the Flood Data Viewer https://cccommission.maps.arcgis.com/apps/instant/portfolio/index.html?appid=7010cb5c13c44f3ab3a239a614ae9e84

Future Floodplain: The future floodplain is that area encompassed by the additional area landward of the FEMA floodplain to the MC-FRM 2070 1% annual storm extent (identified as "2070 Coastal Flood Exceedance Probabilities (MC-FRM)" data layer on MORIS), and includes flood depths for the MC-FRM 2070 1% annual storm (identified as "2070 Flood Depths for the 1% ACFEP (MC-FRM) data layer on MORIS)".

Minimal Wave Action Area (MiWA): A subarea of the A Zone, as identified on the FIRM and defined in the draft DEP Regulations at 310 CMR 10.36(2). The MiWA is the area where wave heights are expected to be less than 1.5 feet.

Moderate Wave Action Area (MoWA): A subarea of the A Zone, also known as Coastal A Zone, as identified on the FIRM and defined in the draft DEP Regulations at 310 CMR 10.36(2). The MoWA is the area where wave heights are expected to be equal to or greater than 1.5 but less than 3 feet.

Non-Water-Dependent Use: Non-water-dependent uses are those which may be located on waterfront property, but do not rely on their close proximity to the water. Examples of non-water-dependent uses include retail and commercial outlets, hotels, offices, restaurants, gas stations and residences.

Predicted Path of Wetland Migration: Areas adjacent to existing salt marsh, coastal beach, barrier beach, coastal dune, coastal bank or rocky intertidal shore where the wetland resource is predicted to migrate due to rising sea-levels. Applicants should consult the Massachusetts Sea Levels Affecting Marsh Migration (SLAMM) model (intermediate high SLR scenario), or other best available model recognized by the Commonwealth, to identify the predicted path of wetland migration. At a minimum, the predicted path of wetlands migration shall be presumed to include the adjacent 100 ft buffer zone of the wetland resource, unless topography or other factors predict a differing pattern of wetland migration.

Present Floodplain: The floodplain as defined and delineated by the Federal Emergency Management Agency (FEMA) as V and A Zones – areas impacted by storm driven wave action and/or inundated by flood waters. The V and A zone maps (FEMA Flood Maps) are delineated by FEMA.

Water-Dependent Use: In general, water-dependent uses are those that require direct access to or location in tidal or inland waters. Examples of water-dependent uses include piers, wharves, marinas, boathouses, shoreline protection, jetties, revetments, seawalls, ripraps and floats.

SUMMARY OF METHODS

GOAL | COASTAL RESILIENCY

To prevent or minimize human suffering and loss of life and property or environmental damage resulting from storms, flooding, erosion, and relative sea level rise, including but not limited to that associated with climate change.

Objective CR1 – Minimize development and risk within areas vulnerable to flooding

METHODS

All DRIs in the Present (FEMA) and Future Floodplain must:

- Limit new development in V zones to water-dependent uses
- Limit new nonwater-dependent development in the Coastal A-zone (Moderate Wave Action area, or MoWA)
- Avoid development or redevelopment in the A-zone (Minimal Wave Action area, or MiWA) and Future Floodplain
- Avoid exacerbating flood conditions
- Accommodate the Predicted Path of Wetland Migration
- Use NAVD88 datum, or a more recent vertical datum from the National Spatial Reference System
- Use construction best practices to prevent damage to the site or dislodging material into flood waters
- Store hazardous materials outside the Present Floodplain

Objective CR2 – Plan for erosion

All DRIs on or near coastal banks must:

- Limit new development on or within 150 ft of a coastal bank to water-dependent uses and only if the applicant can show that there is no feasible alternative and that impacts are minimized and mitigated
- Provide an adequate setback from the top of the coastal bank to reflect long-term erosion rates

- Redevelopment Projects: Demonstrate that there is no feasible alternative to redevelopment on or within 150 ft of a coastal bank and minimize and mitigate impacts

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Objective CR3 – Restore coastal resource areas to promote their natural beneficial functions

METHODS

- Remove existing development in coastal resource areas
- Restore or rehabilitate salt marsh, beach, dune or floodplains, or restore the ability for coastal resources to migrate naturally

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DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE CR1

Objective CR1 *– Minimize development and risk within areas vulnerable to flooding*

ALL DRIS IN THE PRESENT (FEMA) AND FUTURE FLOODPLAIN MUST:

V Zones: Limit new development in V zones to water-dependent uses

New nonwater-dependent development is not permitted in V zones. In limited circumstances, new development of water dependent uses may occur in V zones (also known as high-hazard areas), provided that the applicant can demonstrate that there is no feasible alternative and that development impacts are minimized and mitigated. A showing of no feasible alternative should include an evaluation of alternative locations for the water dependent use that could achieve the goals of the project. Unless precluded by the specific use, water dependent structures should be elevated to the DFE for MC-FRM or building code, whichever is higher.

Coastal A Zones: Limit new nonwater-dependent development and redevelopment in the Coastal A-zone (Moderate Wave Action area, or MoWA)

New nonwater-dependent development within Coastal A zones (Moderate Wave Action area or MoWA) is not allowed, except where the following conditions are met:

1) the applicant can demonstrate that (a) there is no feasible alternative, (b) the impacts have been minimized and mitigated, and (c) there is an overriding public purpose; or

2) the development is proposed in a Community Activity Center or Maritime Area Placetype and the applicant can demonstrate that impacts have been minimized; or

3) the development proposed is public infrastructure and the applicant can demonstrate an overriding public purpose; provided, however, that where public infrastructure is proposed to remedy an existing problem or need within the floodplain, it should not result in the promotion of additional development within the floodplain.

Redevelopment is not allowed in Coastal A zones unless the applicant demonstrates that removing development or relocating it on the site to reduce hazard exposure is not feasible. Where relocating development to reduce hazard exposure (including

reducing project footprint or intensity of use in the Coastal A zone) is not feasible, reconstruction within the existing development footprint may be permitted provided there is no increase in impervious footprint or intensity of use from the prior use or structure. Increased intensity of use may include, but is not limited to, increases in wastewater flow, gross floor area, impervious area, or parking spaces, or conversion from seasonal to year-round use. Redevelopment projects that increase intensity of use or impervious footprint will be evaluated as new development.

Maintenance of existing public infrastructure and water-dependent structures is permitted in Coastal A Zones.

The following development is not permitted in the Coastal A Zone: New seawalls or other hard coastal engineered structures designed to control erosion; new structural fill; or fill for mounding septic systems.

Stairs and access features must be removable for storm damage prevention. Fences must have open slats to allow for flood water movement.

Green infrastructure (also known as nature-based solutions) and restoration projects within the floodplain are supported, provided the applicant can demonstrate that impacts associated with the project have been minimized, and mitigated as may be necessary, recognizing that restoration projects typically serve to mitigate impacts associated with the restoration.

Avoid new development or redevelopment in the A-zone (Minimal Wave Action area, or MiWA) and Future Floodplain

Applicants must avoid new development or redevelopment in A zones (Minimal Wave Action Area or MiWA) to protect coastal resources natural beneficial functions (including, but not limited to, hazard mitigation and habitat). Thus, new development within A zones (Minimal Wave Action Area or MiWA) and the Future Floodplain may be permitted only where the following conditions are met:

1) the applicant can demonstrate that there is no feasible alternative and that the impacts have been minimized and mitigated; or

2) new development is proposed in a Community Activity Center or Maritime Area Placetype and the applicant can demonstrate that impacts have been minimized; or

3) the development proposed is public infrastructure and the applicant can demonstrate an overriding public purpose; provided, however, that where public infrastructure is proposed to remedy an existing problem or need within the floodplain, it should not result in the promotion of additional development within the floodplain.

Where redevelopment is proposed in the A Zone or Future Floodplain, redevelopment may be permitted provided there is no increase in impervious footprint or intensity of use from the prior use or structure. Increased intensity of use may include, but is not limited to, increases in wastewater flow, gross floor area, impervious area, or parking spaces, or conversion from seasonal to year-round use. Redevelopment projects that increase intensity of use or impervious footprint will be evaluated as new development.

Maintenance of existing public infrastructure and water-dependent structures is permitted in A Zones and Future Floodplains.

Fill is allowed only if the applicant can demonstrate that it will not result in adverse redirection or channelization of flood waters.

Green infrastructure (also known as nature-based solutions) and restoration projects within the A Zone and Future Floodplain are allowed, provided the applicant can demonstrate that impacts have been minimized and mitigated.

Avoid exacerbating flood conditions

Development and redevelopment must be designed to address anticipated sea level rise and floodwaters. The applicant must demonstrate that 1) the project will not redirect, channelize or exacerbate flood conditions or ponding in wetlands or on other properties through provision of a flood risk analysis, and 2) structures are elevated to the Design Flood Elevation (DFE). Structures should be designed to weather the elements and avoid short-term obsolescence (which also results in waste of resources). Where development activity may be allowed on beaches, dunes, and salt marshes, structures should be built on open pilings to allow for storm flowage, wave action, and resource migration.

FEMA recognizes that certain historic properties may not be suitable for full elevation where the setting for the building is important in defining its historic character. The Commission may also apply flexibility in requiring elevation of a historic structure where doing so would significantly alter the building's historic qualities. However, all efforts

must be made to mitigate flood risk to a historic structure that will not undermine the structure's historic designation.

Accommodate the Predicted Path of Wetland Migration

Development or redevelopment within the Predicted Path of Wetland Migration must preserve vegetated areas, and limit new or expanded impervious surfaces. Applicants are advised to consult Massachusetts EEA's Sea Level Affecting Marshes Model (SLAMM) resources, including maps, to understand resources that are anticipated to migrate and possible migration direction. Projects proposing work in or near areas of wetland migration will be evaluated based on current and proposed conditions on the site. Applicants proposing work within areas of likely wetland migration should provide an assessment of impacts prepared by a coastal engineer or wetland scientist, and should consider conditions based on the Intermediate High Scenario and the 2070 time horizon, unless a case can be made for considering a shorter time horizon. At a minimum, the predicted path of wetland migration shall be presumed to include the adjacent 100 ft buffer zone of the wetland resource, unless topography or other factors predict a differing pattern of wetland migration. New septic systems are prohibited within the predicted path of wetland migration. Unavoidable development must be mitigated consistent with provisions in the Wetland Technical Bulletin, ideally within the area of the predicted path of wetland migration.

Use NAVD88 datum, or a more recent vertical datum from the National Spatial Reference System

The most recent Mean Sea Level datum available for a site must be used to determine base flood elevation and inform all coastal construction activities. When determining Mean Sea Level, applicants must use the 1988 datum of NAVD88, or the most recent datum based on the National Tidal Datum Epoch.

Use construction best practices to prevent damage to the site or dislodging of material into flood waters

During new construction or redevelopment, construction materials must be stored and secured to prevent damage from flood waters or dislodging into flood waters. Hazardous materials should not be stored in the floodplain unless in limited quantities required for construction operations and secured in a flood protected location. Fences and gates must be installed with the posts anchored in the ground and the fence or gate panels must be placed above the ground and constructed with open slats or other

openings so as to allow water to pass under and through the fence or gate. Use anchoring and wet- and dry-floodproofing measures, as appropriate.

Store hazardous materials outside of the present floodplain

New construction must store hazardous materials outside of the floodplain to avoid the mobilization of these materials into the environment during a storm event. Redevelopment must also store hazardous materials outside of the floodplain unless some aspect of existing conditions on the site precludes this precaution.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE CR2

Objective CR2 – Plan for erosion

ALL DRIS ON OR NEAR COASTAL BANKS MUST:

Limit new development on or within 150 ft of a coastal bank to water-dependent uses and only if the applicant can show that there is no feasible alternative and that impacts are minimized and mitigated

The Wetlands Protection Act Regulations (310 CMR 10.30) define coastal banks as "the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland." Eroding coastal banks are a principal source of sediment for beaches, dunes, and barrier beaches. Coastal banks also serve as vertical buffers to storm and flood waters.

New development is not permitted on or within the 150-foot buffer to a coastal bank except for: water-dependent development provided the applicant shows that there is no feasible alternative, that the impacts to the natural functions of coastal resources are both minimized and mitigated, and that the development is designed to address anticipated sea level rise. Exceptions may also be made for the following activities provided the applicant demonstrates that best available measures are utilized to minimize adverse impacts on all critical coastal resources:

- Bank nourishment and non-structural restoration projects that do not impair the natural beneficial functions of the resource, including temporary fencing and other devices composed of natural material intended to facilitate the resources' natural beneficial function. Monitoring and maintenance plans may be required.
- Appropriately designed and sited pedestrian walkways and elevated decks with appropriate orientation, height, and spacing between planks to allow sufficient sunlight penetration to maintain underlying vegetation and resource migration.
- Maintenance and use of existing public boat launching facilities.
- Maintenance of existing public infrastructure.
- Maintenance required to preserve the aesthetics or structural integrity of existing marine infrastructure.
- Underground utility crossings that do not disturb protected resources.

Provide an adequate setback from the top of the coastal bank to reflect long-term erosion rates

All nonwater dependent development proximate to a coastal bank must be set back from the top of the coastal bank at least 50 times the average annual erosion rate of the shoreline or 150 feet, whichever is greater. Development should be located as far landward of the coastal bank as is feasible within a site.

The average annual rate of shoreline erosion is determined by averaging the erosion over the previous 30-year period, at a minimum, or other time frame determined by the Commission, to appropriately reflect current and future shoreline conditions.

Calculating a setback from the top of the coastal bank of at least 70 times the average annual erosion rate of the bank is encouraged. Doing so reflects the typical 70-year lifetime of a residential building, based on a study conducted for the Federal Insurance Administration to establish reliable estimates for the life of residential coastal structures.

Redevelopment Projects: Demonstrate that there is no feasible alternative to redevelopment on or within 150 ft of a coastal bank and minimize and mitigate impacts

Redevelopment, where there is no increase of intensity of use, may be permitted on or within 150 feet of a coastal bank provided the applicant shows there is no feasible alternative, that there is no increase in impacts to the natural functions of coastal resources, and that the project is designed to address the effects of anticipated sea level rise on proposed structures. The applicant must evaluate relocating development on the site to reduce hazard exposure and impacts to natural functions of coastal resources. Redevelopment should be designed to have no adverse impact on the function of the bank as a natural sediment source to the coastal system.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE CR3

Objective CR3 *– Restore coastal resource areas to promote their natural beneficial functions*

Remove existing development in coastal resource areas

In coastal resource areas, prior to considering redevelopment, the applicant should evaluate the potential for removing or reducing development from coastal hazard areas, or moving development landward to reduce risk. Removal of development from sensitive coastal resource areas is encouraged. Where redevelopment is allowed, existing development should be removed from the most sensitive areas of the site to allow for restoration and resource migration.

Coastal resource restoration

Coastal resources provide multiple beneficial functions, including protecting coastlines and landward properties from storms and flooding. Consistent with objectives CR1 and CR2, activities intended to restore the natural beneficial functions of coastal resource areas are permitted. Natural and/or non-structural methods for coastal restoration are encouraged. Activities might include, but are not limited to, beach, dune and bank nourishment; salt marsh, fish run, or shellfish bed restoration; revegetation with native plant species; temporary fencing and other approaches employing natural materials designed to re-establish or create natural forms and functions. Development and redevelopment consistent with CR1 and CR2 should incorporate coastal restoration and use of native plants into landscape and revegetation plans to address disturbed areas of the site.

GENERAL APPLICATION REQUIREMENTS

Applicants are required to submit the following as part of their DRI application:

- Site plan showing delineation of all coastal resources and the 100 ft buffer to those delineations.
- If development is proposed within coastal resource areas or buffers, plans detailing the development proposed should be provided, including site plans of existing and proposed conditions, and planting plan for restoration of the site. A geotechnical report should also be provided to substantiate the safety and stability of any coastal structures.
- Narrative discussing the alternatives considered, and plans of the alternatives, as appropriate.
- To help demonstrate development in the floodplain will not exacerbate flood conditions consistent with CR1, a flood risk analysis must be provided. A flood risk analysis is a hydrodynamic modeling analysis performed to assess any potential flooding changes (flood depth and extent), and velocity changes (redirection and concentration of flood flows) associated with the proposed development. The analysis should evaluate flooding under current and future flood conditions and indicate the potential for adverse effects to the site, adjacent properties, and infrastructure for the useful life of the development. The analysis should account for the effects of wave action and show modeled depths, velocities, and pathways of present and future floodwaters.

REFERENCES

Regional Policy Plan Data Viewer

Flood Area Design Guidelines for Cape Cod. These guidelines were developed to review the main strategies available for reducing or eliminating hazards from sea level rise and storm surge to life and the built environment while also protecting the region's distinctive character and historic resources, both in the short term and the long term.

Floodplain Data Viewer. This GIS-based data viewer provides a visual representation to illustrate the potential effects of historic and future floods. The floodplain data viewer provides existing FEMA flood extents and future flood extents projected by the Massachusetts Coast Flood Risk Model (MC-FRM).

Low Lying Roads Viewer. Low lying roads are areas prone to flooding from the combined effects of hazards such as sea level rise, storm surge, and erosion. The viewer displays inundation probability, and criticality scores, to determine the top vulnerable roads for each town.

Model Coastal Resilience Article and Wetlands Regulations. The Commission developed model wetlands and zoning bylaws, and wetlands regulations that address the management of development in the floodplain. Geared for municipal adoption, these resources may also help guide appropriate development in the floodplain.

The Massachusetts Office of Coastal Zone Management (CZM) maintains several maps and viewers that should be consulted when proposing a coastal project, including:

- Massachusetts Sea Level Rise and Coastal Flooding Viewer (https://www.mass.gov/info-details/massachusetts-sea-level-rise-and-coastal-flooding-viewer)
- Shoreline Change Project and Coastal Erosion Viewer (https://www.mass.gov/info-details/massachusetts-shoreline-change-project)
- Sea Level Affecting Marshes Model (SLAMM) (https://www.mass.gov/info-details/sea-level-affecting-marshes-model-slamm)